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## FOREWORD

This issue of the *ICF Quarterly Report* focuses on the final section of the 192-arm, 1.8-MJ National Ignition Facility (NIF). We describe both technological advances necessary for optimal utilization of the delivered energy and the hohlraum physics resulting from extremely high energy densities.

Two articles belong to the first category. The conversion of infrared light to ultraviolet occurs at the tripler in the NIF's Final Optics Assembly. It is then necessary to separate any unconverted (first- and second-harmonic) light from the tripled-frequency light passed to the target. "Large-Aperture Color-Separation Gratings for Diverting Unconverted Light Away from the NIF Target" (p. 33) describes the design and fabrication of novel diffraction gratings that fulfill this function. In both direct- and indirect-drive ICF, the symmetry of the capsule as it compresses is crucial. The NIF will have 48 clusters of four beams incident on targets. "Optimization of Beam Angles for the National Ignition Facility" (p. 15) presents the rationale used to assign beam angles for cylindrical indirect drive while still allowing direct-drive and tetrahedral indirect-drive experiments to be performed.

The high-energy environment near the NIF target complicates high-spatial-resolution x-ray microscopy, which has proved very useful in ICF studies. "High-Energy X-Ray Microscopy at the National Ignition Facility" (p. 23) investigates target-mounted pinholes and reflective-optic imaging systems as short- and long-term approaches. "Hohlraum Radiation-Drive Measurements on the Omega Laser" (p. 1) combines experiments and computer simulations to clarify previous discrepancies between radiation temperatures measured through side holes on cylindrical hohlraums with those predicted from simulations. Side-hole measurements "see" a limited area of the opposite hohlraum wall and miss some laser hot spots that contribute significantly to the radiation temperature. The new results indicate the considerable advantage of measuring radiation temperature through the laser entrance hole (LEH) rather than through a side hole. Measurements made through the LEH are in much better agreement with simulations. "Hohlraum Energetics with Smooth Laser Beams" (p. 7) correlates measured radiation temperature with losses due to stimulated Brillouin scattering and stimulated Raman scattering. Our results demonstrate that beam smoothing with kinoform phase plates and smoothing by spectral dispersion is successful in limiting such scattering losses in low- $Z$ , gas-filled hohlraums to a few percent at a laser intensity of  $2 \times 10^{15} \text{ W/cm}^2$  and only 7% at an intensity of  $4 \times 10^{15} \text{ W/cm}^2$ .

The "fast ignitor" approach to laser fusion uses an ultrashort, intense laser pulse to create forward-directed "hot electrons" in the coronal plasma surrounding a target precompressed by another laser pulse. At the high laser intensities involved (on the order of  $10^{19} \text{ W/cm}^2$ ), plasma electrons oscillate at relativistic energies. The feasibility of such a scheme depends, in part, on the efficiency with which laser energy can be transferred to forward-directed plasma electrons. "Laser-Electron Conversion Efficiency at Intensities Greater than  $10^{19} \text{ W/cm}^2$ " (p. 28) presents the first experimental demonstration of 30 to 40% conversion for 400-fs pulses of intensity  $2$  to  $4 \times 10^{19} \text{ W/cm}^2$ .

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